Homework 4

Scientific Methodology in practice

In the case studies we imagine that you are a well-paid computer consultant to many different computer companies. How would you apply the scientific method in the following cases? (If you find the descriptions ambiguous, use your own interpretation. There are no unique correct answers.)

Describe the methods you would use in each of the cases below and motivate all your answers. You are free to use all tools (math, programming etc) and sources.

1. *Morton's* antivirus program examines the file 32 bytes at a time and checks in a hash table if the sequence of bytes is present in any known virus. The table size is $N = 1048576 \ (= 2^{20})$ and the hash is linear. You have the vague feeling that in the Inda course you were told that N should be prime and that quadratic hashing is faster.

   Should you ask Morton to rewrite the program?

2. *Svenska Benchmark* uses a Java program to measure and compare software performance. One problem is that the timer, which inherits from `java.util.TimerTask`, is unreliable with regard to timing. It seems like a Java machine with better scheduling is needed, such as the one sold by *QuickSoft* for $100,000. You are asked to give your opinion on whether this would be a good deal.

   You study the table of runtimes:

time	QuickSoft	Sun	MicroSoft	Apple	IBM
10	0.1	0.4	0.3	0.4	0.5
100	0.2	0.5	0.4	0.6	0.9
1000	0.4	0.9	0.4	0.6	1.1

   Figure 1: Average delays for different intervals (QSInstitute, 2010)

   What is your recommendation?

3. The software development departments at Ericsson are considering replacing all screens with the hyped brand *SilentScreen*. The inaudible high-frequency sounds produced by other screens lower a programmer's productivity by an average of fifteen percent. At least that is what companies that have implemented the change say, including Nokia. Since the investment is huge, your recommendation carries great responsibility.

   What do you do?

4. As we all know, there are three different *software development paradigms*: top-down, bottom-up and inside-out. But which one is best? You have three programmers who are willing to set up an experiment and three new assignments have just come in.

   How do you set up the experiment?

5. The import company *Hubbe* is selling routers for 2000 SEK. From experience we know that one router out of a hundred is defective, so each router is tested before sale and if it fails the test it is discarded. The loss of goodwill from selling a faulty router is estimated at 10,000 SEK.

   Testing costs 100 SEK per machine and detects errors with 98 % probability. In one case out of a thousand a good machine is rejected. Hubbe (an old classmate of course) is planning to market a more expensive test that costs 120 SEK per machine but detects errors with 99 % probability and never rejects a good machine.

   Hubbe trusts you - can you give her some advice?

6. You have a brilliant business idea - a consultant consultancy *Escapen* that fills the gap when a computer consultant is on vacation. You have advertised for a skilled assistant and now have hundreds of candidates to interview. The problem is that if you say "*Thanks, we will call you later*" the person will have taken a different job when you call, so you have to make up your mind directly.

   What scientific methodology should you use?

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